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A COMPARISON OF THE FOOD HABITS OF BRITISH
AND AMERICAN STARLINGS.

BY E. R. KALMBACH.

Economic ornithology has pointed out few if any more regrettable instances of change in the economic relations of a bird than that which occurred and is still transpiring in the case of the Starling in Great Britain. While the earlier research workers in the field of economic ornithology in the British Isles were aware of the potential power for harm in the Starling should it ever become overabundant, they were satisfied, that in normal numbers this bird was one of the most beneficial. Gilmour, Newstead, Theobald, McGowan, and Collinge all recognized the admirable qualities of this bird as a destroyer of terrestrial insect pests and urged its conservation. As long ago as 1913, however, Dr. Walter E. Collinge, the eminent Scottish biologist, sounded a note of warning that the increase of the Starling population was rapidly bringing about a change in the economic status of the bird. At that time he said:¹ "As has long been contended by agriculturalists, numerically this bird has increased enormously during the last ten or twelve years. This increase I believe to be largely due to migration and the protection afforded to wild birds in general. Considerably reduced in number, I believe the Starling would regain the good name it has borne in the past, and prove a most useful bird to the farmer; at present it is far too numerous and a source of considerable loss."

In April, 1919, Dr. Collinge stated further² that at that time "the Starling offers a most serious menace to the production of home grown food, and any further increase in its numbers can only be fraught with the most serious consequences." In his latest contribution³ to this pressing subject the same authority prefaces his remarks by the unequivocal assertion that "for many years past there has been taking place a sure but gradual

¹ The Food of Some British Wild Birds, p. 49. London, 1913.

² The Plague of Starlings. National Review, No. 434, pp. 252-257, April, 1919.

³ The Starling: Is It Injurious to Agriculture? Journal of the Ministry of Agriculture, Vol. XXVII, No. 12, pp. 1114-1121, March, 1921.

change of opinion with reference to the economic status of the Starling, for from one of our most useful wild birds it has become one of the most injurious. Its alarming increase throughout the country threatens our cereal and fruit crops, and the magnitude of the plague is now fully realized."

So emphatic a condemnation of a species by the leading economic ornithologist in Great Britain must necessarily attract the attention of all engaged and interested in the agricultural problems of that country during this period of reconstruction, and it doubtless will result in some aggressive measures being taken to reduce the number of this species to the point where it again may render its efficient aid as a check on insect life without exacting an unfair toll for its services. For the farmers and bird students of this country Dr. Collinge's castigation of the Starling in its native home carries with it much food for thoughtful consideration. A discussion of the recent findings concerning its economic relations abroad compared with the result of investigations in this country, where the Starling has obtained a firm foothold, consequently seems called for. Fortunately, in his recent studies of the food habits of birds, Dr. Collinge has used the volumetric method of stomach analysis, identical with the procedure in vogue for many years in this country and used in the recent study of the food of the Starling in the United States,¹ This permits comparisons in a way that heretofore has been impossible.

In explanation of the great increase of the Starling in Great Britain and the resultant change in its economic status we are told that it is due "*firstly*, to the security of its nesting site; *secondly*, to the change in its food habits; and *thirdly*, to the autumnal immigration." Either one of the latter two phenomena alone might easily result in disaster when an economically important species is involved. "There is fairly reasonable evidence," Dr. Collinge states, "to show that in the past the bulk of the food consisted of insects and insect larvae, slugs, snails, earthworms, millepedes, weed seeds, and wild fruits; in more recent years this has been supplemented by cereals and cultivated fruits and roots."

¹ Economic Value of the Starling in the United States. By E. R. Kalmbach and I. N. Gabrielson. Bulletin 868, U. S. Dept. of Agriculture (Biological Survey), pp. 1-66, pl. 1-4, January 10, 1921.

As a resident of the east coast of Scotland for four years he attests to the countless thousands of migrating Starlings that reach the British Isles from the northeast. Within his comparatively limited field of observation he reported daily the arrival of flocks of 1,000 to 5,000 in September of 1915. "In 1916, the numbers seemed less but they increased again in 1917, and in 1918, they outnumbered anything seen previously. . . . One flock alone contained something between 150,000 and 200,000 birds, and on the 9th of September a still larger flock was seen. This immigration of course occurs all along the eastern coast of England and Scotland, so that the actual number of arrivals must total many millions."

As a basis for determining the economic influences of the Starling in Great Britain, Dr. Collinge had available the stomachs of 368 adult birds secured from various districts and during every month of the year. These were used in an investigation concluded in October, 1918. To compare with his results we have the data from the examination of 2,157 stomachs of adult Starlings collected in the centers of Starling abundance in this country mainly during 1916. A tabular presentation of the food percentages as determined in each of these investigations will permit an easy comparison:

Food Items	Per cent in Great Britain	Per cent in the United States
Animal food.....	51.00	57.00
Vegetable food.....	49.00	43.00
Injurious insects.....	26.50	34.66
Neutral insects.....	3.50	1.74
Beneficial insects.....	2.50	4.89
Earthworms.....	8.50	Negligible
Slugs and snails.....	6.50	0.94
Millipeds.....	1.50	11.71
Miscellaneous animal matter.....	2.00	1.58
Cereals.....	20.50	1.16
Cultivated roots and leaves.....	2.50	Negligible
Cultivated fruits.....	15.50	4.41
Wild fruits and weed seeds.....	7.00	23.86
Miscellaneous vegetable matter.....	3.50	13.57

At the outset, the division of the food into its elementary animal

and vegetable portions reveals a significant difference between the British and American Starlings. Nearly half the sustenance of the British birds comes from the vegetable kingdom, while in the food of the American birds a difference of 14 per cent. exists between the two portions. Analysis of the differences in the percentages of the component parts of the food yields startling, and, for us, gratifying, results. In the consumption of injurious insects of various kinds the Starlings of this country surpass the British cousins in a signal manner: of neutral insects they take about half as many: and of beneficial forms they eat 4.89 per cent. as compared with 2.50. This record of a greater consumption of beneficial insects is due largely to the inclusion in this estimate most of the ground beetles (*Carabidae*) eaten by the American birds. There is no doubt that a great part of these insects, especially members of the genera *Anisodactylus*, *Amara*, and *Agonoderus*, so frequently eaten by Starlings, possess marked vegetarian habits and rightly should be credited as neutral or injurious. The high percentage of earthworms consumed by the British birds is indicative of feeding during rainy spells or in a naturally more humid climate. The American birds subsist to a considerable extent on earthworms during prolonged rainy spells but forsake such food as soon as dry weather keeps these annulates below the surface. Slugs and snails, some of which are pronounced pests in the British Isles, are much less common in areas frequented by the Starling in this country, a situation reflected in the food percentages. In the case of the millipeds eaten, however, an anomalous situation presents itself. These myriapods have been generally recognized as a menace to gardens in Europe, where they at times are very abundant. In the United States, however, their injurious habits, though recognized, have attracted much less attention—too little perhaps, if their frequency in the Starling's food is a fair index of their abundance. Over a ninth of the Starling's annual food in this country is secured from this source, whereas in Europe the bird takes only about an eighth of this, proportion.

As it is in the consumption of its vegetable food that the Starling's greatest powers for damage lie, it is especially gratifying to learn that in this respect our Starlings show the most marked

difference in food preferences from their relatives abroad. With a less pronounced vegetarian diet to begin with our Starlings present a very commendable record when this portion of their food is subjected to careful analysis. The most bitter complaints to-day against the Starling in England concern its depredations on sprouting grain and these are convincingly substantiated by the percentage of cereals eaten by the birds examined. Over a fifth of their food came from this source, wheat being frequently attacked. In this country, however, the Starling's limited granivorous propensities are satisfied mainly at the expense of ripening corn (maize). Even the percentage of 1.16 given for the American bird conveys an exaggerated idea of the damage it inflicts on growing or ripened grain, as much included under this item was gleaned from chicken yards or was waste grain picked up during the winter months. In its feeding on truck crops there is a possibility that the negligible percentage recorded against our bird does not adequately represent the change that at times occurs. In its consumption of cultivated fruit the American bird again presents a better record, especially when it is realized that about a third of that consumed was secured from frozen apples pecked into during the winter months. As a cherry thief, however, our bird is doubtless as proficient as the British one. The abundance of acceptable wild fruits, wild black cherries, elderberries, sour gum berries, bayberries, and the fruit of sumacs, both poisonous and non-poisonous, is a dominating factor in neutralizing the effect of the Starling's vegetarian diet in this country; and likewise the lack of a supply sufficient to meet avian needs is probably an important reason for the Starling's objectionable vegetarianism in England. There it consumed less than a third the quantity of such food eaten by the Starling in America. The ability (or necessity) of the American bird to make out a living in close proximity to densely populated sections is reflected in its consumption of miscellaneous vegetable food during winter, secured mainly from garbage dumps. In this activity it has shown marked proficiency.

Thus in five of the more important of the twelve categories into which Dr. Collinge has segregated the food of the British Starlings, namely injurious insects, millipeds, cereals, cultivated roots and

leaves, and cultivated fruits, we find the American bird has a better record. The consumption of five others, neutral insects, earthworms, miscellaneous animal matter, wild fruits and weed seeds, and miscellaneous vegetable matter, may be considered neutral in its aggregate effect. On the basis of the figures presented the American bird has made a less satisfactory record in the consumption of only two items—beneficial insects, of which it eats more; and slugs and snails, of which it takes a very few. Even here the offense becomes less when it is considered that many vegetarian species of carabids were included in the percentage of beneficial insects in the estimates for the American bird, and that in the United States injurious slugs and snails are by no means so abundant or destructive as in England.

A segregation of the percentages of the foregoing tabulation, after the manner employed by Dr. Collinge in this recent presentation of the case of the Starling, will permit a comparison of the aggregate influences for good and harm in the birds of the two countries.

Activities	In Great Britain (Per cent)	In America (Per cent)
Beneficial		
Animal food.....	34.50	47.31
Neutral.		
Animal food.....	14.00	3.80
Vegetable food.....	10.50	38.85
Total.....	24.50	42.65
Injurious.		
Animal food.....	2.50	5.89
Vegetable food.....	38.50	4.15
Total.....	41.00	10.04

Such strongly contrasting evidence leaves not a shadow of doubt as to the marked economic superiority of the American bird based on a study of food habits at this time. The degree to which the American bird is more or less culpable than the British as a destroyer of other birds can not be determined for lack of comparative evidence. A discussion of this phase of the Starling's economic influence in this country will be found in the treatise pre-

vously alluded to in this discussion.¹ The same may be said regarding a discussion of the objectionable nature of the birds' fall roosts.

In addition to recognizing the overwhelming economic superiority of the American bird over his foreign relative, there is no recent evidence materially to change the decision regarding it in this country made in Bulletin 868 of the Department of Agriculture: "Most of the Starling's food habits have been demonstrated to be either beneficial to man or of a neutral character. Furthermore, it has been found that the time the bird spends in destroying crops or in molesting other birds is extremely short compared with the endless hours it spends searching for insects or feeding on wild fruits. Nevertheless, no policy would be sound which would give the bird absolute protection and afford no relief to the farmer whose crops are threatened by a local overabundance of the species. Consequently, the enactment of laws that afford protection to the Starling, except when it is actually doing or threatening to inflict damage, appears to be the wisest procedure. With its ready ability to adapt itself to new environments, the Starling possesses almost unlimited capacity for good, but it is potentially harmful in that its gregarious habits may abnormally emphasize some minor habit which would be indulged in at the expense of growing crops. The individual farmer will be well rewarded by allowing a reasonable number of Starlings to conduct their nesting operations on the farm. Later in the season a little vigilance will prevent these easily frightened birds from exacting an unfair toll for services rendered."

U. S. Biological Survey, Washington, D. C.

¹ Bulletin 868, U. S. Dept. of Agriculture (Biological Survey), 1921.